

WHAT IS CLAIMED IS:

1. An electromagnetically driven valve control apparatus for a multi-cylinder internal combustion engine, comprising:

5 electromagnetically driven valves, each of which is at least one of an intake valve and an exhaust valve that are provided in each of cylinders of the internal combustion engine, and each of which is driven using electromagnetic force; and

 a controller provided with processing units, each of which controls the electromagnetically driven valves in each of plural valve groups, each of the plural valve
10 groups including the electromagnetically driven valves whose opening periods do not overlap with each other while the internal combustion engine is operated in a low speed low load region.

2. The electromagnetically driven valve control apparatus according to claim 1,
15 wherein the electromagnetically driven valves provided in the cylinders are divided into the plural valve groups such that each of the plural valve groups includes the electromagnetically driven valves in different cylinders, whose opening periods do not overlap with each other while the internal combustion engine is operated in the low speed low load region.

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3. The electromagnetically driven valve control apparatus according to claim 2,
 wherein a control cycle of each of the processing units when the electromagnetically driven valves are operated to be opened/closed can be changed based on whether or not opening/closing operations of the plural electromagnetically driven valves in each of the
25 valve groups overlap with each other.

4. The electromagnetically driven valve control apparatus according to claim 3,
 wherein the control cycle is shortened when the opening/closing operations of the plural electromagnetically driven valves in each of the valve groups overlap with each other.

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5. The electromagnetically driven valve control apparatus according to claim 1, wherein plural intake valves are provided in each of the cylinders, the electromagnetically driven valves are divided into the plural valve groups such that each of the plural valve groups includes the plural electromagnetically driven valves constituting the plural intake
5 valves in each of the cylinders, and only one valve of the plural intake valves in each of the cylinders is operated to be opened/closed while the internal combustion engine is operated in the low speed low load region.

6. The electromagnetically driven valve control apparatus according to claim 5,
10 wherein a control cycle of each of the processing units when the electromagnetically driven valves are operated to be opened/closed can be changed based on whether or not only one valve of the plural intake valves in each of the cylinders is operated.

7. The electromagnetically driven valve control apparatus according to claim 6,
15 wherein the control cycle is shortened when the only one valve of the plural intake valves in each of the cylinders is operated.

8. The electromagnetically driven valve control apparatus according to claim 1, wherein plural exhaust valves are provided in each of the cylinders, the
20 electromagnetically driven valves are divided into the plural valve groups such that each of the plural valve groups includes the plural electromagnetically driven valves constituting the plural exhaust valves in each of the cylinders, and only one valve of the plural exhaust valves in each of the cylinders is operated to be opened/closed while the internal combustion engine is operated in the low speed low load region.

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9. The electromagnetically driven valve control apparatus according to claim 8, wherein a control cycle of each of the processing units when the electromagnetically driven valves are operated to be opened/closed can be changed based on whether or not only one valve of the plural exhaust valves in each of the cylinders is operated.

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10. The electromagnetically driven valve control apparatus according to claim 9, wherein the control cycle is shortened when the only one valve of the plural exhaust valves in each of the cylinders is operated.

5 11. The electromagnetically driven valve control apparatus according to claim 1, wherein each of the plural valve groups includes the electromagnetically driven valves of cylinders in which an intake timing and an exhaust timing are shifted each other by 360 degrees in terms of a crank angle.

10 12. The electromagnetically driven valve control apparatus according to claim 1, wherein the multi-cylinder internal combustion engine is an in-line six-cylinder internal combustion engine, and each of the plural valve groups includes the electromagnetically driven valves of cylinders in which an intake timing and an exhaust timing are shifted each other by 240 degrees in terms of a crank angle.

15 13. An electromagnetically driven valve control method for a multi-cylinder internal combustion engine in which at least one of an intake valve and an exhaust valve that are provided in each of cylinders is configured as an electromagnetically driven valve that is driven using electromagnetic force, comprising the steps of:

20 dividing the electromagnetically driven valves into plural valve groups such that overlap of concentrated control periods for the electromagnetically driven valves in each of the valve groups is minimized; and

 controlling the electromagnetically driven valves in each of the valve groups using a single control body.

25 14. The electromagnetically driven valve control method according to claim 13, wherein each of the plural valve groups includes the electromagnetically driven valves whose opening periods do not overlap with each other while the internal combustion engine is operated in a low speed low load region.

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15. The electromagnetically driven valve control method according to claim 14,
wherein the electromagnetically driven valves provided in the cylinders are divided into
the plural valve groups such that each of the plural valve groups includes the
electromagnetically driven valves in different cylinders, whose opening periods do not
5 overlap with each other while the internal combustion engine is operated in the low speed
low load region.

16. The electromagnetically driven valve control method according to claim 15,
further comprising the step of:
10 changing a control cycle of each of the processing units when the
electromagnetically driven valves are operated to be opened/closed on the basis of whether
or not opening/closing operations of the plural electromagnetically driven valves in each of
the valve groups overlap with each other.

17. The electromagnetically driven valve control method according to claim 13,
wherein plural intake valves are provided in each of the cylinders, the electromagnetically
driven valves are divided into the plural valve groups such that each of the plural valve
groups includes the plural electromagnetically driven valves constituting the plural intake
valves in each of the cylinders, and only one valve of the plural intake valves in each of the
15 cylinders is operated to be opened/closed while the internal combustion engine is operated
in the low speed low load region.

18. The electromagnetically driven valve control method according to claim 17,
further comprising the step of:
25 changing a control cycle of each of the processing units when the
electromagnetically driven valves are operated to be opened/closed on the basis of whether
or not only one valve of the plural intake valves in each of the cylinders is operated.

19. The electromagnetically driven valve control method according to claim 13,
30 wherein plural exhaust valves are provided in each of the cylinders, the

electromagnetically driven valves are divided into the plural valve groups such that each of the plural valve groups includes the plural electromagnetically driven valves constituting the plural exhaust valves in each of the cylinders, and only one valve of the plural exhaust valves in each of the cylinders is operated to be opened/closed while the internal
5 combustion engine is operated in the low speed low load region.

20. The electromagnetically driven valve control method according to claim 19, further comprising the step of:

changing a control cycle of each of the processing units when the
10 electromagnetically driven valves are operated to be opened/closed on the basis of whether or not only one valve of the plural exhaust valves in each of the cylinders is operated.